

Storage Ring Status, Issues

G. Decker 5/94

I. Status

- A. Beneficial Occupancy 4/94**
- B. Approx. 60% of girders installed**
- C. First sector bake heat tests yield few 10^{-10} torr**
- D. Vacuum closures to begin in earnest this month**
- E. Power supply installation proceeding**
 - 40 convertor cabinets in place**
 - First raw supply tested, mass production this month**
- F. First RF high power system tests in progress**

II. Issues

- A. Water flow induced vibrations**
- B. Thin injection septum**
- C. Chamber protection, MPS**
- D. Commissioning planning**

Water Flow Induced Vibrations Specification

- I. Only recently has a complete girder/ cooling system installation been available for characterization.**
 - A. Includes magnet/chamber cooling, bellows in the tunnel.**
 - B. Up to this time, an open ended vibration spec has been used.**
 - C. Focus has been on damping structural resonances.**
- II. Both ground motion, water flow induced vibrations are present, but water appears to dominate.**
 - A. Definitely true horizontally, almost true vertically.**
 - B. This was not observed in tests with temporary water connections.**
- III. Amplification factors for orbit motion**
 - A. Horizontal:**
 - 1. Approx 50 for uncorrelated magnet motions
 - 2. Approx 20 for girder motions
 - B. Vertical comparable to horizontal**
- IV. Orbit stability specification**
 - A. 17 microns rms at $\beta_x = 14$ meters**
 - B. 4.5 microns rms at $\beta_y = 10$ meters**
- V. Maximum allowable girder/magnet vibration**
 - A. 17 microns / 20 = 0.85 microns rms horizontally for girders**
 - B. 17 microns / 50 = 0.34 microns rms horizontally for magnets**
 - C. 4.5 microns / 20 = 0.225 microns rms vertically for girders**

Machine Protection System Requirements

VI. Bending Magnet Radiation:

- A. Machine passively safe up to 100 mA.**
- B. Above 100 mA, vertical excursions up to ± 0.6 mrad, or ± 4 mm are allowed.**
- C. Horizontal mis-steering is not a problem.**

VII. Insertion Device Radiation

- A. Vertical stay-clear is ± 0.8 mrad**
- B. Horizontal stay-clear is ± 1.8 mrad**
- C. Note: mis-steering allowance is smaller than stay-clear**

VIII. Global Closed Orbit Distortions

- A. Global orbit distortions are quite common, and generally easy to detect, since they can be seen at nearly all BPM locations. Global orbit distortions are generally caused by hardware failures such as a malfunctioning corrector magnet or orbit feedback system.**

IX. Local Closed Orbit Distortions

- A. Detection of local orbit distortions is significantly more difficult, requiring a small number of diagnostics. This necessarily has a negative impact on availability, for example when interlocking each dipole magnet and insertion device individually. Local orbit distortions not caused by local feedback are generally a result of human error.**

Diagnostic Options

X. Wire Monitors

- A. Used to detect vertical mis-steering of bending magnet radiation.**
- B. Re-located to be immediately downstream of photon exit port gate valve.**
- C. +: Conceptually simple, potentially very reliable.**
- D. +: Completely solves both global and local vertical bending magnet radiation mis-steering problem.**
- E. -: Untested - prototype test late July, NSLS.**
- F. -: 80 required, very expensive (\$5k/unit, plus electronics).**

XI. RF beam position monitors

- A. +: Numerous, provides voting options for global interlock.**
- B. +: Already paid for.**
- C. -: Technically complex.**
- D. -: Only a partial solution for the bending magnet problem, unless 160 are used with no voting, resulting in poor system availability.**

XII. X-ray beam position monitors

- A. +: Ultra high resolution, monitors quantity of most interest.**
- B. +: Available for every insertion device.**
- C. -: Not all BM lines instrumented.**
- D. -: Limited dynamic range, +- a couple of mm.**

XIII. Corrector Strengths

- A. A strategy of limiting corrector strength changes can be used to control local orbit distortions in combination with a global interlock.**
- B. +: Quickly available from feedback system**

Injector Commissioning Plans

XIV. Major items impacting operation/ commissioning

- A. Completion of HET line and booster extraction test**
- B. Modulator upgrade**
- C. PAR septum upgrade**
- D. Positron generation**

XV. HET line installation work takes place days, studies at night. Coordination issue only.

XVI. Modulator upgrade

- A. Review 6/22, may imply some limitations on ops.**
- B. This could impact schedule for production quantities of 450 MeV positrons. It should be possible to achieve 250 MeV positrons using linac S3 plus S4 or S5. Modulator 4 or 5 may be needed exclusively for upgrade related testing and prototyping.**
- C. Significant work on booster does not make sense at this low energy. Electrons will be used until 450 MeV positrons are available, through and including the two-sector test to take place in August.**

XVII. PAR septum upgrade

- A. Present septum may be adequate for stacking. Mark I was not. If Mark II is not adequate, single bunch PAR operation will have to continue until Mark III available. Mark III septum necessary for 60 Hz operation in any case, since water cooling is required.**

XVIII. Positrons

- A. Last piece of positron convertor hardware to be installed week of 6/13. Linac hardware then complete.**
- B. First test production of positrons can begin during dedicated linac studies periods. Objective to produce and accelerate positrons up to PAR with highest attainable energy.**
- C. PAR will remain wired for electrons until after two sector test in August.**
- D. Two week down period required to relocate to master control room. It has been decided to perform the two sector test from the ICR, relocate afterwards.**

XIX. Planning

- A. Studies objectives, data are discussed at weekly machine physics meetings (wednesdays), and weekly commissioning team meetings(thursdays).**
- B. Studies schedule available on [www/mosaic to](http://www.mosaic.to) project.**
- C. Day to day operations notes, studies objectives, also on line**
- D. Studies log on line.**
- E. On line operations / fault / maintenance logs coming soon - must be in compliance with conduct of operations document (which is on-line).**

Storage Ring Commissioning Plans

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XX. Establish preconditions for two sector test (2ST) 8/94

XXI. 4 GeV 2ST radiation measurements

XXII. 7 GeV 2ST radiation measurements

XXIII. Storage ring ready

A. SAD

B. ARR - hardware ready

XXIV. Establish first turn @ 7 GeV (on-axis injection)

XXV. Carry out further radiation measurements

XXVI. Circulate beam

A. Early lattice characterization, tunes

XXVII.RF capture

XXVIII.Orbit correction, lattice characterization

XXIX. Stack

XXX. Beam characterization, emittances, instabilities, etc.

XXXI. Commission closed orbit feedback systems

XXXII.Commission beam abort interlock

XXXIII.Install first insertion device chamber

XXXIV.Commission first insertion device